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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Geon-Ook Park

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08/03/2006

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EXAMINER

TOBERGTE, NICHOLAS J

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 08/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/748,652	PARK, GEON-OOK	
	Examiner	Art Unit	
	Nicholas J. Tobergte	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 June 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1, 5 and 9 is/are allowed.
- 6) ☒ Claim(s) 2, 3, 7 and 8 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn. This withdraws the advisory action filed 7/13/06. The amendments filed 6/28/06 will now be entered and prosecution will be continued with a new non-final rejection. This was discussed in a phone interview with the Applicant on 7/19/06.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 2, 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (US 6,008,526) and further in view of Kao et al (US 20030170964 A1) and Chou et al (US 5,933,748).

Pertaining to claims 7 and 2, Kim teaches a method for forming a trench in a semiconductor device comprising:

forming a pad oxide film **2** and a silicon nitride film **4** on a semiconductor substrate **1**;

Art Unit: 2823

selectively etching the silicon nitride film **4** and the pad oxide film **2** on a region to be formed with a trench **Col 2 lines 28-31**;

implanting oxygen ions into the semiconductor substrate in the region to be formed with the trench **Col 3 lines 50-56**;

forming an oxide in the semiconductor substrate by reacting the oxygen ions with the semiconductor substrate through a thermal diffusion of the oxygen ions **Col 3 lines 42-48**;

forming the trench by etching the semiconductor substrate and the oxide on the region to be formed with the trench using the silicon nitride film as a mask **Col 2 lines 26-31 and Fig 2B**;

forming a liner oxide film **8** on an inner wall of the trench using a thermal diffusion process **Col 2 lines 34-35**

wherein an edge at which a side and a bottom of the trench intersect has a curved surface. **See Fig 2B.**

Kim fails to teach wherein the mask used in the etch is the silicon nitride film.

Kim fails to teach wherein the substrate is comprised of a silicon substrate.

Kim fails to teach forming an insulation film on the liner oxide film such that the trench is filled, wherein an oxide film is formed on an entire top surface including the silicon nitride film and the trench such that the trench is filled, and then the oxide film is chemically and mechanically polished until the silicon nitride film is exposed

Art Unit: 2823

Kao teaches the use of a silicon nitride mask when etching a trench in an ion implanted semiconductor substrate. **[0027-0033]**. Therefore it would be obvious to one of ordinary skill in the art at the time the invention was made to apply the teachings of Kao to the process of Kim. The motivation for doing this would be to decrease the number of photoresist masking layers as well as utilize a mask that is impermeable to implanted ions such as a silicon nitride mask **[0033]**.

Kao teaches the use of a silicon substrate **[0025]**. Kao discloses that silicon is a typical semiconductor substrate material, and therefore would be obvious to one of ordinary skill in the art to choose such a well known and obvious material in the art at the time the invention was made.

Chou teaches forming an insulation film on the liner oxide film such that the trench is filled, wherein an oxide film is formed on an entire top surface including the silicon nitride film and the trench such that the trench is filled, and then the oxide film is chemically and mechanically polished until the silicon nitride film is exposed. **Col 4 lines 48-65**. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the teaching of Chou with that of Kim, the reason is that some oxide layers require a densification process, which is why the oxide layer is formed to cover the entire device and the trench allowing it to sit before being removed via a CMP. **Col 4 lines 48-65**.

Art Unit: 2823

Pertaining to claim 3 Kim teaches the method of claim 2, wherein, in selectively etching the oxidation blocking layer **34** and the pad oxide film **32**, a first photosensitive film pattern **36** for exposing the oxidation blocking layer on the region to be formed with the trench is formed by applying, exposing, and developing a photosensitive film on the oxidation blocking layer, and then the oxidation blocking layer and the pad oxide film exposed are selectively etched using the first photosensitive film pattern as a mask **See Fig 4A**.

Kim fails to explicitly point out that silicon nitride is an oxidation blocking layer.

Kao teaches that silicon nitride is used as an oxidation blocking layer **[0033]**.

Therefore it would be obvious to one of ordinary skill in the art at the time the invention was made to expose the trench using a photosensitive film on the oxidation blocking layer (silicon nitride film) and the pad oxide layer, the motivation being that this is a conventional photolithography process known in the art at the time the invention was made.

Pertaining to claim 8, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

Art Unit: 2823

Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. Ex parte Ishizaka, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. In re Burckel, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Allowable Subject Matter

Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 1, 5 and 9 are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas J. Tobergte whose telephone number is 571-272-6006. The examiner can normally be reached on Mon - Thur 7am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NJT


MICHELLE ESTRADA
PRIMARY EXAMINER